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Australasian Plant Conservation

BULLETIN OF THE AUSTRALIAN NETWORK FOR PLANT CONSERVATION

VOLUME 13 NUMBER 1 • JUNE - AUGUST 2004



Urban Plant Conservation at ARCUE
Managing and Restoring Urban Natural Areas
Re-instigating Natural Disturbance Regimes in Urban Areas
Conserving Threatened Ecological Communities in Perth
What do Traffic Islands have to do with Conservation?
And much much more....

Special Edition - URBAN PLANT CONSERVATION

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Australasian Plant Conservation Editor

Tricia Hogbin, and thanks to Tracey Armstrong, Rosemary Purdie, Leonie Monks, and Bob Makinson.

Australasian Plant Conservation is produced by the ANPC Inc. with assistance from the Australian National Botanic Gardens and Australian Centre for Urban Ecology (this special edition).

Australasian Plant Conservation is printed on recycled paper.

ISSN 1039-6500

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Front cover: Steele Creek grassland. Photo: Nicholas Williams **Back cover (top to bottom):** Translocation of *Caladenia* sp. aff. *fragrantissima* seed. Photo: Andrew Pritchard; *Caladenia* sp. aff. *fragrantissima* Photo: Mike Duncan; Emma Watt & Chris Todd planting *Epacris stuartii* on Southport Island (Tas). Photo: Paul Black; **Cover design:** Siobhan Duffy. **Printed by:** Pirion, Canberra.

President's report

Judy West
Centre for Plant Biodiversity Research
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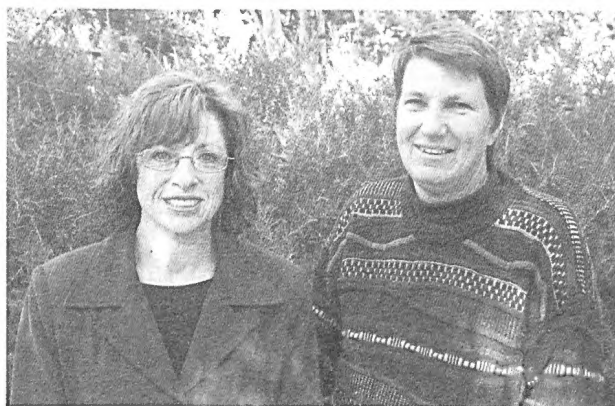
In this issue I would like to provide some feedback on ANPC activities during the past three months, introduce some of the ANPC activities to occur over the next 6-8 months, and welcome our new staff.

Firstly, it is great that we have been able to appoint two new staff. Pam Strickland is applying her efficient practices to management of the ANPC office - she currently works Monday and Friday each week. Sally Stephens is employed full-time as a project officer to take the lead on organising training workshops as part of two environmental grants awarded to ANPC (see below). Sally comes to ANPC from the federal Department of Environment and Heritage where she has worked on threatened species, Bushcare communications, and local government liaison, among other areas. I welcome both Pam and Sally on behalf of the National Committee and appreciate the enthusiasm with which they are tackling the varied tasks.

The second edition of the *Guidelines for the Translocation of Threatened Plants in Australia* was launched on the 4th June at the Royal Botanic Gardens Sydney, associated with the second NSW translocation workshop. Given the continued use of translocation as a conservation tool, and the occurrence of some inappropriate practices, the ANPC recognised the need to revise the guidelines, and the organisation is grateful to the NSW Environmental Trust for supporting preparation of the guidelines and making them widely available. The first edition (1997) was taken up by a wide range of conservation practitioners, in the government, private, and community sectors, as an invaluable resource to guide translocation projects. This new edition, supported by the NRM



Authors of *Guidelines for Translocation of Threatened Plants in Australia* (Second edition), from left: Leonie Monks, Bob Makinson, Tricia Hogbin, Laura Vallee, Maria Matthes and Maurizio Rossetto. Photo: Stevie King



New staff from left, Pam Strickland and Sally Stephens
Photo: Laura Vallee

Ministerial Council, reflects advances in scientific practice and the greatly increased practical experience in translocation. In particular, the new guidelines include greater emphasis on evaluating whether a translocation effort is justified and practical, new case studies have been added and operational sections have convenient checklists to aid recovery teams and personnel.

At the end of April, 92 participants took part in an ANPC training workshop on *Ecological Restoration for Mountain Environments - Approaches and Techniques*. The three day workshop was structured around a combination of presentations and background talks together with on-site (mainly Kosciuszko area) viewing and discussion. The workshop attracted participants with a wide range of interests, including from industry (mining, hydroelectricity, alpine resorts, engineering, horticulture and rehabilitation material manufacturers), non-government conservation organisations, local government, universities, CSIRO and CRCs, Bushcare and Bush Regeneration consultants and contractors, environmental consultants, and State and Commonwealth Government agencies. Feedback has been very positive with many post-workshop contacts and appreciative comments, particularly relating to the quality of scientific presentations and experienced personnel and the format of field inspections mixed with formal presentations, or the "travelling roadshow of ecological rehabilitation work in progress". ANPC wishes to thank TransGrid for their strong support in running this workshop.

Following the successful workshop on translocation of threatened plants at Mount Annan Botanic Garden in February, a second translocation workshop along the same lines was held in Sydney at the Royal Botanic

Gardens on the 4th June with about 40 participants. This too was attended by officers from local government, state agencies, community groups and environmental consultancy companies, who found the sessions "very practical and hands-on, all presenters up to date with latest information" and commented especially on the case study scenario discussions to assist in translocation practices.

Further translocation workshops are being planned for other jurisdictions, particularly in Victoria, Western Australia, Queensland and possibly South Australia. If you are interested in attending please contact the ANPC national office or see the flyer provided with this issue for information about the Victorian workshop to be held in Bendigo 24th September. The Victorian workshop is sponsored by the Department of Sustainability and Environment, with assistance also provided by the North Central Catchment Management Authority.

Continuing ANPC's role in facilitating interactions and transferring knowledge from current research findings to those practitioners responsible for on-ground management, during the next 16 months ANPC will be organising a series of six training courses in remnant protection and rehabilitation in regional NSW and south-east Queensland, under the guidance of our project officer, Sally Stephens.

The Queensland workshops will be run in conjunction with the Queensland Herbarium, with support from WWF Queensland.

The small remnant patches that are closest to most of us living in urban and suburban areas have received less conservation attention than

those beyond our big cities. In an attempt to raise awareness of urban conservation issues and to draw attention to some of the scientific approaches now being implemented, this issue of APC focuses on the theme of urban conservation. ANPC is pleased to have support from the Australian Centre for Urban Ecology (ARCUE) in producing this issue of APC. If you have suggestions of other themes that you would like to see APC cover in future issues please feel free to contact me or the ANPC office.



Judy West and Tim Entwistle, launching the revised Translocation Guidelines. Photo: Stevie King

Australian Research Centre for Urban Ecology plant conservation research projects

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Mark J. McDonnell and Nicholas S. Williams

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Australia is one of the most urbanised countries in the world with 88% of Australians living in cities of 100,000 people or more. In the past agricultural activities have caused most extinctions, but now many plants and animals under threat occur in urban areas. Cities will therefore have a large impact on their chances of survival in the future.

In the past, much of our ecological knowledge has been developed from studies in places remote from human settlements. However, many 'islands' of natural habitat survive in suburbia including forests, woodland, grassland, rivers, wetlands and coasts. In order to preserve and

manage these remnants, and the biodiversity they contain, we must have a much more detailed understanding of the important ecological processes operating and how they differ from wilderness and rural areas. This knowledge must be coupled with community education about the great value of these areas and their conservation so that Australians can continue to appreciate them into the future.

In recognition of these needs, in 1998 the Royal Botanic Gardens, Melbourne, with generous assistance from the Baker Foundation, established the Australian Research Centre for Urban Ecology (ARCUE). Although the Centre is a Division of the Royal Botanic Gardens, for practical reasons it is located in the School of Botany at the University of Melbourne. ARCUE is one of the few research centres in the world having its prime focus on the conservation of biodiversity in cities and towns. The scope of ARCUE's activities encompass basic and applied research, postgraduate training and research, community education and training programs, policy and management advice to all levels of government, and consultancy services.



Australian Research Centre
for Urban Ecology

Over the past six years ARCUE staff and students have conducted a range of research projects focusing on the conservation of indigenous plants and animals in urban areas. These have been conducted in a variety of ecosystems and have addressed both basic and applied ecological questions as well as providing the baseline information essential for conservation planning by governments. An example of the latter work is the comprehensive remnant vegetation mapping of Melbourne's suburbs that the Centre provided to the Victorian Department of Sustainability and Environment. In the following sections we will discuss in more detail our research programs on the ecology of grasslands and heathlands in the greater Melbourne area.

Grasslands

Native grasslands are one of the most endangered ecosystems in Australia. It is therefore surprising to most people that despite recent losses due to urbanisation, substantial areas of native grassland remain in and around cities such as Melbourne, Canberra and Geelong. Grassland research projects at ARCUE have focused on understanding the ecology of these unique ecosystems: We have been especially interested in investigating the impacts of landscape fragmentation and edge effects on the composition and structure of the plant communities. Our botanical surveys of grasslands in the Melbourne area have discovered many previously unknown populations of the endangered Plains Rice-flower (*Pimelea spinescens*) and a single population of Button Wrinklewort (*Rutidosia leptorhynchoides*) in a suburban park less than 10 km from the centre of the city.

We have analysed grassland fragmentation patterns in Melbourne through the development of a temporal GIS dataset spanning the period 1985 to 2000 that recorded the extent and distribution of native grassland patches. Of the 7,230 ha of native grassland present in 1985, 1,670 ha (23%) were destroyed by development and 1,469 ha (21%) were degraded to non-native grassland by 2000. There were fewer patches and greater distance between patches in 2000 than in 1985, indicating that fragmentation has intensified. Logistic regression models determined that patches that were privately or government owned, close to major roads and close to Melbourne had a higher probability of being destroyed while patches close to streams or on railway land had a lower probability of destruction but high susceptibility to weed invasion. Studies are underway to compare these results with grassland in Canberra and a rural area. By understanding the risk factors that result in the destruction of grasslands we are able to better prioritise our conservation efforts.

We have also investigated the effects of landscape variables and plant attributes on the local extinction of grassland species from remnants over a 20 year period. Analyses are continuing, but results suggest that grassland species are more likely to become locally extinct at urban sites compared to equivalent rural sites. This is particularly the case if the

sites at which they occur are small and have not had a history of regular burning, and the species are geophytes or flat rosettes that are dispersed by either wind or ants. These research efforts are continuing into the future and will focus on investigating grassland edge effects and floristic variation across western Victorian grasslands.

Heathlands

The heathlands occurring in the suburbs south-east of Melbourne have been the subject of several ARCUE studies. Initial research compared the composition and structure of urban heathlands to those in rural areas. Analyses indicated that differences in composition and structure between urban and rural heathlands were correlated with the amount of urbanisation of the landscape and that these differences were probably at least partly related to changed disturbance regimes in the urban landscape. Further research investigated the soil seedbank of heathlands finding that burnt areas of urban sites had significantly more seed in the soil seed bank than unburnt areas. This was due to the reduced numbers of heath species in the unburnt vegetation of urban sites. In contrast, unburnt areas of rural sites retained many heath species in the vegetation, and at these sites no significant differences were detected between the soil seed banks from burnt and unburnt areas.

Recent heathland research has investigated the invasion of *Leptospermum laevigatum* into heathland remnants due to fire-suppression in Melbourne. Local councils have been reclaiming invaded patches by burning *L. laevigatum* after the original heathland community has spent 50 to 60 years confined to the soil seedbank. The vegetation of reclaimed heathland was surveyed and compared with nearby patches of intact, uninvaded heathland. We found that although reclaimed heathlands have retained 85 % of their original species diversity, they have lost important dominant species including *Leptospermum myrsinoides*, *Hypolaena fastigiata*, *Banksia marginata* and *Allocasuarina paradoxa* and are now dominated by *Bossiaea cinerea*, *Aotus ericoides*, *Hibbertia sericea* and other hard-seeded species that have been able to persist in the soil seedbank. Patches of heathland in the Royal Melbourne Golf Club that have been managed exclusively by slashing for over 70 years were also surveyed and compared with reclaimed and uninvaded heathlands. Slashed sites have retained *L. myrsinoides* and *B. marginata*, although species richness has been reduced in the shrub layer and increased in the herbaceous layer where grasses such as *Microlaena stipoides* are common.

Further information on ARCUE's research activities can be obtained by visiting our website at <http://arcue.rbg.vic.gov.au>.

Acknowledgements

The research activities of ARCUE are funded, in part, by The Baker Foundation.

The management and restoration of urban and suburban natural areas¹

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The preservation, restoration and ecologically sound management of urban and suburban natural areas are crucial to the maintenance of global, regional and local biodiversity. Throughout the world the number and size of urban areas are increasing. It has been predicted that by the year 2025 over 60% of the world's population will be living in urban settlements. Unfortunately, our ecological understanding of the world has been obtained from studying natural areas specifically selected to minimise the presence of humans. This situation has begun to change over the last decade as ecologists around the world have gained a new appreciation for the importance of ecological research in urban and suburban environments.

Urban natural areas are ecosystems that persist due primarily to natural processes with minimal human intervention. In addition to their intrinsic value, they are especially important for providing unique examples of pre-urbanised ecosystems at a local scale and are refugia for indigenous plants and animals. This makes them valuable sources of propagules and organisms for future restoration projects. Patches of indigenous vegetation located in cities and towns are also vital living laboratories for environmental education providing many urban dwellers their only opportunity to experience and learn about the region's natural heritage. Urban and suburban natural areas in Australia and throughout the world are facing many serious problems that threaten their persistence. The conservation, management and restoration of these valuable areas present a formidable challenge to all cities and towns around the world.

The ecologically sound management and restoration of urban and suburban natural areas requires: 1) the identification of achievable management and restoration goals and objectives; 2) understanding the constraints of managing and restoring remnant patches of native vegetation in urban and suburban landscapes; 3) managing remnant patches of vegetation as complex systems as opposed to a collection of things; and 4) the necessity of using adaptive management and restoration techniques.

Determining goals and objectives

The success of maintaining and restoring natural areas in urban and suburban environments depends upon having clear achievable goals. The goals and objectives of management and restoration projects in urban and suburban natural areas can address a variety of topics ranging in degree of difficulty and costs. In order of increasing difficulty and costs, these include maintaining, altering or restoring: 1) the physical conditions of a site; 2) plant

community composition and structure; and 3) ecosystem functions such as nutrient cycling. The restoration of the physical conditions of a site should be one of the first objectives of any restoration project. Such projects might involve stabilising an eroding slope or improving water quality.

Urban constraints to management and restoration

Urban constraints are imposed by the existing conditions within a natural area or site and the area surrounding the site (i.e., landscape context). The size and shape of a site will determine the amount of edge versus core interior habitat. Typically, urban natural areas in the centre of cities are small to moderate size ecosystems with minimal core interior habitat. Conversely, these systems tend to have a large amount of boundary edges resulting in numerous categories of physical and ecological "edge effects." These "edge effects" can have both positive and negative impacts on ecological systems. Thus, management and restoration strategies need to reduce negative edge effects such as the invasion of non-native species while favouring those aspects of the edge that lessen harmful impacts on the site.

Manage and restore systems not 'things'

Typically, natural areas in cities exhibit a variety of environmental conditions and a diversity of organisms. Plant and animal communities that are to be managed and restored exist due to multiple interactions between environmental conditions and living organisms. These components and their interactions form a dynamic ecological system (ecosystem) that is affected by the types, age and abundance of organisms and the changes in environmental conditions over time. Thus, when developing management and restoration plans it is important to focus on the "systems" and not just the plants that currently occupy the site.

The role of adaptive management

Dynamic ecological systems require adaptive management and restoration strategies that rely on a close connection between the management and restoration efforts, a monitoring program, and the modification of methods and techniques in light of new knowledge. This process is called adaptive management. Through the development of a regular monitoring program it is possible to adjust methods and techniques to maximise short- and long-term success of management and restoration projects. In addition, information gained from monitoring may, in some instances, alter the goals and objectives of a project.

¹ This is a condensed version of a paper entitled "An introduction to the management and restoration of urban and suburban natural areas" which appeared in *Sustain: A Journal of Environmental and Sustainability Issues* 8: 5-10, 2003.

There are numerous risks involved in not developing a monitoring component of restoration and management projects. The most important risk is the potential of the project to cause more habitat degradation. Equally important is the fact that without some form of monitoring there is a potential to allow the perpetuation of untested and inadequate methods and techniques. It is only through the development, monitoring and testing of restoration and revegetation techniques that we can discover and utilise the underlying principles of habitat restoration and management.

Principles for managing urban and suburban natural areas

From my 20 years of experience both in Australia and the United States I would suggest the following guidelines for managing urban and suburban natural areas to reduce human impacts and encourage natural ecosystem processes. First, the integrity of the native patches of vegetation should be maintained by minimising existing trails and preventing the creation of new trails; this should be followed by minimising the disruption of nutrient cycling processes (e.g., keep dead wood and organic material in the system); reducing the inputs of harmful chemicals, energy, water and organisms

when possible; development of appropriate management to reduce impacts of edges on patch interiors; and preserving native genetic diversity by propagating and using plants from within the natural areas and nearby remnant patches of vegetation. Finally, in urban and suburban environments every effort should be made to create new habitat on the edges of remnant patches to serve as buffer zones.

Acknowledgements

I would like to thank Amy Hahs for her constructive comments on earlier drafts of the manuscript. This research was funded, in part, by The Baker Foundation.

Suggested readings

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Hiding in a remnant patch of bush near you

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Remnant vegetation in urban areas is typically fragmented and small in scale. Remnants have large edges relative to the size of the remnant and may be heavily disturbed by human activity and weed encroachment. At the same time, urban remnants may have high conservation value as fragments of endangered ecological communities; as habitat



Grevillea caleyi seedling in a sea of *Acacia saligna* seedlings after fire. Photo: Tony Auld

for threatened, rare and common plant and animal species and as amenity and an educational resource for the people who live in the urban centres.

One of the key problems for urban bushland management is attempting to maintain the biodiversity values of the bushland under the weight of urban pressures. One aspect that is important for remnants in urban areas is the maintenance of natural disturbance regimes that allow species within the remnants to complete their life cycles. Without such disturbance regimes it is likely that a number of species would be lost and, in many cases, weedy species may be favoured. A typical example for our coastal cities is the role of fire in the persistence of plant populations.

Here we present a summary of the results of integrating the application of fire and weed management to small urban remnants in the northern suburbs of Sydney.

The problem

The Duffys Forest endangered ecological community is restricted to the northern suburbs of Sydney. Some 85% of this shrubby woodland community has been cleared and the remainder is severely fragmented and degraded by



Ecological burn. Photo: Tony Auld



Regeneration soon after burn. Photo: Tony Auld

small-scale disturbances and weeds. A number of the remnants of this community now occur in areas surrounded by roads, housing, parkland or small semi-rural properties that have been cleared of their native vegetation. As a consequence, these remnants do not get burnt in the periodic wildfires that sweep through the surrounding extensive National Park bushland. Many remnants have not been burnt for decades and are becoming invaded by weeds, especially those with bird dispersed seeds such as privet, lantana and the native *Pittosporum undulatum* (this species does not naturally occur in these habitats). At the same time, the diversity of the above ground native flora has declined and it was important to understand just how much of this diversity was still present and viable as a soil seed bank or dormant bud/rhizome bank.

One solution

The recovery program for the endangered plant *Grevillea caleyi*, a species that occurs in several urban vegetation remnants, identified the long-term conservation of Duffys Forest habitats containing the species as a priority for management. In isolated remnants, this has involved a combination of re-introducing fire to sites and extensive pre- and post-fire weed control. In this case an ecological burn was carried out in October (spring) when conditions were suitable. The work described here was undertaken in collaboration between the Department of Environment and Conservation NSW (DEC formerly NSW National Parks and Wildlife Service (NPWS)), Warringah Council and the NSW Rural Fire Services, using resources from each and a grant from the Foundation for National Parks and Wildlife. We chose to re-introduce fire, as opposed to applying other fire related seed germination cues, such as the application of smoke by itself, for several key reasons. Recent work by Kenny (2003) suggests that seeds of most species in the

Sydney area have a response to the interaction of heat and smoke, rather than a simple response to smoke alone. Other species require heat for seed germination (legumes) or fruit opening (*Hakea* and *Banksia* species with seeds held in woody fruits). Finally, the heat of the fire will kill a number of small weedy tree and shrub species to assist control of these species.

The Results

A comparison of pre- and post fire sampling showed marked changes in the composition and abundance of species. The biggest changes for native plants were in shrubby species that are killed by fire and have a long-lived soil seed bank. A number of such species were either absent or in very low numbers pre-fire. Post-fire they were the dominant component of the shrubby understorey with densities up to 300 plants per 100m². Typical species in this group were *Acacia myrtifolia*, *Boronia ledifolia*, *Grevillea* spp. (including patches of the endangered *Grevillea caleyi*), *Lasiopetalum ferrugineum*, *Pimelea linifolia* and *Platysace linearifolia*. In contrast, there was little change in abundance for the mid storey shrub dominants that are killed by fire but have canopy seedbanks (*Banksia marginata* and *Hakea sericea*). The canopy seedbanks of these species were depleted pre-fire as most of the fruits were quite old and had already opened releasing the seed. For plants capable of resprouting, a few species were absent pre-fire, but appeared following the fire, having resprouted from viable rhizomes or bulbs from under the ground. For example, the understorey plants *Dampiera stricta*, *Haemadorum corymbosum*, *Haemadorum planifolium*, and *Scaevola ramosissima* were absent pre-fire but appeared post-fire. A number of species resprouting from underground stems and rootstocks also had lots of new seedling recruitment, in particular the grasses *Anisopogon avenaceus*, *Entolasia*

stricta and *Microlaena stipoides*. There was also increased germination of a number of native species occurring outside their natural range (in this case the western Australian *Acacia saligna*, and the eastern Australian *Acacia elata*). On-going control of these species is essential, as they can behave like weeds in this community.

The implications

Re-instigating natural disturbance regimes, such as fire, into urban vegetation remnants that are isolated can have positive outcomes for conservation. In this case the best outcome was achieved when combined with extensive weed control and strong support from local government. Species with long-lived soil seedbanks may only exist as seed in the soil in long-unburnt remnants and these species will need a fire to germinate, grow, flower and replenish their soil seedbanks. Even a few species with rhizomes or bulbs may be hiding in the soil, awaiting the opportunity to re-shoot, flower and set

seed. Of course, the challenge now is to determine an appropriate fire regime (ie. how often, what season, how intense) for these urban remnants to allow persistence of all the species within them. That is a whole other story, but it is possible to obtain sound advice on these issues from DEC. In NSW the Rural Fire Service co-ordinates a program of hazard reduction burning in urban centres. Both the Rural Fire Service and DEC can assist with planning for proposed ecological burns, including helping with issues relating to planning, approvals, ecological impacts and the risks associated with the use of fire.

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Greenweb in the Sutherland Shire, Sydney

Geoff Doret

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The Greenweb concept is a regional approach to the conservation of the remaining biodiversity of the Sydney basin. It was introduced to the Sydney Regional Organisation of Councils in 1997 and later adopted as "Green Web Sydney". Sutherland Shire Council, on the southern outskirts of Sydney, developed its own Greenweb Strategy and implemented the program in the local area in September 2002.

Greenweb aims to protect and enhance native plant and animal populations by identifying key areas of bushland habitat and establishing interconnecting 'linkages' or corridors. These corridors run through public and private lands and connect islands of bushland, making it easier for the movement and interchange of fauna and flora. This helps to maintain healthy populations and diversity and ensures the long-term sustainability of the natural environment.

Sutherland Shire is fortunate to have significant areas of bushland which will benefit from the Greenweb program, including marine and freshwater wetlands, woodlands, heathlands, forests, rainforests and dunal communities. Some of these plant communities have been listed as endangered ecological communities such as Kurnell Dune Forest, Littoral Rainforest, Sydney Turpentine Ironbark Forest and Sydney Freshwater Wetlands. Many of the bushland areas also support rare or threatened plant species.

Although Greenweb incorporates both public and private lands, its main target is private property owners, particularly

those within the Greenweb network. In a complementary program, the council's Bushcare Unit undertakes bushland regeneration activities on public land.

The focus is on voluntary participation with incentives to encourage people to participate. These include the council's Greenweb Officer inspecting the resident's property and providing a free 'garden consultation'. The visits may involve identifying appropriate native plant species for the area, or will identify appropriate landscaping to encourage native fauna, or identify invasive weed species and will answer any other environmental or horticultural questions.

Appropriate information and regular newsletters are sent to the residents involved. Participating residents also have access to free native tube plants from the council's nursery and in some instances a second greenwaste bin and/or bush regeneration bags are allocated for weed collection. Residents can also receive a free Greenweb sign to acknowledge their efforts and participation in the program.

The council has heavily promoted Greenweb through media releases, displays and presentations with the aid of brochures, videos, posters and power point presentations. The response has been overwhelming and in just over one year (2003), 187 property inspections were undertaken with participating residents. Participation and the amount of work undertaken varies from site to site, but the response and feedback has been very positive and supportive of the program.



School children planting. Photo: Geoff Doret

Schools are also participating in the Greenweb program. Educational talks about Greenweb (bushland and biodiversity), planting days and bush regeneration workshops are also given at several schools.

Regulatory measures are also available when development is proposed on lands identified in the Greenweb network. Existing planning provisions allow Council to assess the impact of development on wildlife habitat, corridors, significant natural features etc. Greenweb has been incorporated in council's new Draft Local Environment Plan (LEP). The LEP establishes a planning framework for future development in Sutherland Shire. Greenweb will clearly identify areas where these environmental issues are particularly important for assessment of applications and ensure an appropriate balance of development and the preservation of the native vegetation and the protection of environmentally sensitive areas.

Council is following-up in the more degraded areas and will continue to target some of the critical links in the Greenweb program.

Regular updating and the provision of information, as well as assistance, support and face-to-face contact are essential to encourage further participation and to maintain commitment and enthusiasm so that the community can manage their properties effectively.

Native plants in traffic islands and road reservations in New Zealand

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While offshore islands offer a more traditional option for native plant conservation in New Zealand, traffic islands and road reservations are now being used in the Wellington region. Urban environments offer areas of public land where plants can be grown on a long-term basis. In the past, mainly exotic plants have been used for this type of planting but in Wellington threatened native plants are being used. If a local authority has to revegetate urban areas then there are several reasons why native plant species and especially

threatened species should be used so the plantings can contribute to protecting New Zealand's unique plant life.

Threatened native plants grown in traffic islands are used as:

- Insurance populations in case the wild population is destroyed
- A research and educational resource
- A source of seeds and plants to be used in species recovery work in the wild.

Threatened plant species grown in traffic islands can be valuable components of a plant conservation programme but can also be attractive parts of the urban landscape. The islands are well protected by the roads that surround them. Browsing animals, such as possums, are unable to access them and council staff keep the islands free of weeds. In Wellington nationally threatened species such as *Muehlenbeckia astonii*, *Pimelea* aff. *aridula* and *Euphorbia glauca* are now protected as captive breeding populations in urban traffic islands. Seed collected from each of these species has been grown to generate plants that have been used in translocation projects to protected areas nearby.

Encouraging local councils to make better use of traffic islands and road reservations for threatened plant conservation outcomes may lead to greater protection and appreciation of our endangered indigenous plant life.



Left: Traffic island sign; right: A captive breeding population of *Muehlenbeckia astonii* in a traffic island in central Wellington.

Photos: John Sawyer

City of Greater Geelong: protecting local biodiversity

Terri Rodaughan

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In recent times there has been a trend in local government towards establishing 'Bush Crews' or natural resource management teams to help manage local bushland and areas of high biological significance. This potential for local government to contribute to plant conservation in Australia has been grasped by the City of Greater Geelong (COGG) with the recent recruitment of a Conservation Reserves Team. Four enthusiastic team members will be helping implement the COGG Biodiversity Strategy with a key focus on biodiversity priorities, best practice, site management planning, monitoring and education.

In 2003, COGG adopted its Biodiversity Strategy, which includes information on the context, background and status of biodiversity in Geelong as well as references to specific biodiversity commitments. The need for such a study arose from the fact that approximately 72% of indigenous flora within COGG are regionally rare, vulnerable, endangered, extinct or poorly known. Many are listed under the *Victorian Flora and Fauna Guarantee Act, 1988* and the *Commonwealth Environment Protection and Biodiversity Conservation Act, 1999*. Examples include the Velvet Daisy Bush (*Olearia pannosa* ssp. *cardiophylla*), the Rare Bitter Bush (*Adriana quadripartita*) and Bellarine Yellow Gum (*Eucalyptus leucoxylon* ssp. *bellarinensis*).

Given the extent of the conservation reserves estate and the limited resources for active maintenance, the Conservation Reserves Team will prioritise their efforts, focusing first on sites of greatest ecological importance within nominated reserves. These areas will require the specialist natural resource management skills of the Conservation Reserves Team.

Another role of the team will be to help develop integrated plant conservation programs, maintenance plans, mapping



The Conservation Reserves Team, from left Terri Rodaughan, Peter Young, John Arnott (Curator - Geelong Botanic Gardens), Lisa Miller and Jon Park.
Photo: Tony Duffield, Geelong Botanic Gardens

programs and habitat assessments. These will help produce management plans for all reserves as part of COGG's strategic asset management and conservation approach.

The team will also help develop educational and training resources for the general community, COGG staff and contractors. This will include information on appropriate practical techniques. Participating in community planting and enhancement days, coordinating volunteers, undertaking biodiversity research, documenting biodiversity values and acting as ambassadors for council in promoting environmental best practice will also be part of the team's role. Accurate record keeping about the status of work, type of activity, changes to biodiversity values and indicators to establish whether biodiversity targets are being met will be a priority.

The work of the team is not by any means replacing work already done by other areas of the council. By negotiation, alternative maintenance techniques may be introduced to other operational areas of the council over time to enhance biodiversity.

The COGG Conservation Reserves Team will add a new focus on plant conservation on public land in the Geelong region and welcomes inquiries.

For a copy of the COGG Biodiversity Strategy, please use the following link:

http://www.geelongaustralia.com.au/Services_In_Geelong/Environment/Strategies_and_Reports/



Velvet Daisy Bush (*Olearia pannosa* ssp. *cardiophylla*)
Photo: Ian Rogers, City of Greater Geelong

Conserving threatened ecological communities in the Perth area

Robyn Luu

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Currently there are 68 listed TECs throughout Western Australia.

Sixteen have specific protection under the *Commonwealth Environmental Protection and Biodiversity Conservation Act 1999*.

Small patches of remnant vegetation in urban areas are extremely important for conserving 'threatened ecological communities' (TECs), i.e. assemblages of plants and animals whose survival is under threat. A number of these communities were located in 1994 in a survey of the Southern Swan Coastal Plain (Gibson *et al.* 1994). Many of these occurrences have now been surveyed and added to a comprehensive database.

The Swan Coastal Plain parallels the coast near Perth and has been extensively cleared - by 97% on the eastern side (Gibson *et al.* 1994) - mainly for agriculture and urban development. Many of the remaining small remnants are now very isolated and under threat. People with knowledge and interest in their local bushland, such as Friends groups, the Wildflower Society and Land Care district committees, are helping to look after these special areas.

In 1999, the WA Threatened Species and Communities Unit (WATSCU) of the Department of Conservation and Land Management (CALM) received funds from the Natural Heritage Trust (NHT) to undertake a three year program aimed at implementing actions identified in recovery plans for TECs near Perth. A number of essential tasks such as weed control, fencing and monitoring were undertaken. Some examples of where there is a cooperative effort between CALM and local groups in managing TECs in urban bushland follow.

Brixton Street Wetlands: herbland and marri woodland TECs

Many of the plant communities associated with wetlands within the Perth Metropolitan area have become rare or even extinct because a large proportion of the wetlands have been destroyed or significantly altered by clearing or filling. A small vegetation remnant near Brixton Street in the Perth suburb of Kenwick contains examples of some of these rare and threatened plant communities.

The Brixton Street Wetlands lie 20 km south-east of Perth near the base of the Darling Scarp. The small remnant is only 19 hectares in size and forms part of the Greater Brixton Street bushland that contains around 127 hectares of vegetation. The reserve occurs on the winter wet flats of the Guilford clays. The wetlands support a very rich flora with over 300 different species of plants, i.e. around 17% of the flora of the Perth area is present in only 0.005% of the area (Keighery and Keighery 1993). Brixton Street wetlands



Bushland regenerators undertaking weed control at Brixton Street wetlands. Photo: Robyn Luu

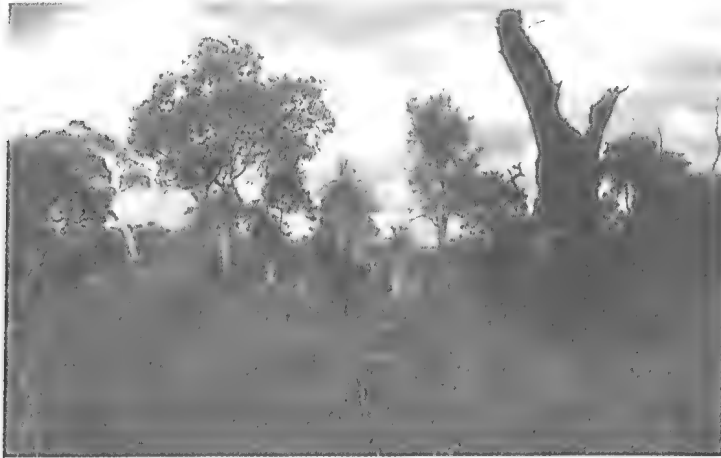
also contain three TEC's. They include rich herblands which cover the winter wet claypans; herb rich shrublands on clay flats; and marri woodlands on the higher ground on better drained soils.

CALM, the Friends of Brixton Street Wetlands, the Environmental Weeds Action Network (EWAN) and other groups have been actively involved in managing the wetlands. Works include fencing, erection of signs, planting, rubbish removal and weed control. A lookout was also built so that the public can view the numerous species of plants and animals that inhabit the site without impacting negatively on the bushland. EWAN, in conjunction with the Friends Group, has been experimenting on methods of controlling particular weeds as well as setting up a bush regeneration demonstration site.

A Fire Management Strategy has been developed in consultation with all stakeholders. This plan aims to help maintain the high conservation values of the site through employing a fire frequency and fire control methods that promote the best regeneration of the bushland.

Talbot Road Bushland: eastern shrublands and woodlands TECs

A number of rare woodlands occur on heavy soils on the eastern side of the Swan Coastal Plain between Waterloo (near Bunbury, south of Perth) and Bullsbrook (north-east of Perth). These heavy soils are ideal for farming and agriculture, and consequently the woodlands that once occurred on them have been extensively cleared. The rarest of these woodlands (which may sometimes occur as shrublands) is dominated by slender banksia (*Banksia attenuata*) and firewood banksia (*Banksia menziesii*), sometimes with sheoak (*Allocasuarina fraseriana*)



The marri woodland TEC. Photo: Val English

(Gibson *et al.* 1994). This community occurs at Talbot Road Bushland near Midland.

The Friends of Talbot Road Bushland, volunteer groups including Green Corp and Conservation Volunteers, students of Joondalup TAFE's environmental science unit, and staff from CALM's Perth Hills District have all been involved in conserving the bushland. Actions that have been undertaken include seed collection, fencing, spraying for the dieback disease *Phytophthora* (that kills many native plants and is spread through the soil) and removal of weeds. Weeds such as bulbil watsonia (*Watsonia bulbifera*), tree lucerne (*Chamaecytisus palmensis*), and Patersons curse (*Echium plantagineum*) are removed through spraying or wiping with herbicide, and hand-pulling. Some of the excessive number of tracks in the reserve have been closed, sprayed with smoke water to promote germination of native seed in the soil, and replanted with seedlings. Funding for many of these actions was provided by the Natural Heritage Trust (NHT) and the World Wide Fund for Nature's (WWF's) Threatened Species Network (TSN).

Muchea: mound springs TECs

The grey 'Bassendean sands' contain the Gngangara Mound, a shallow aquifer that extends from Moore River (approximately 100 km north of Perth) to the Swan River.



CALM staff surveying Mound springs TEC. Photo: Val English

This groundwater is forced to the surface, forming springs, on the eastern boundary of the aquifer where the waters encounter impermeable clays. This permanent supply of fresh water allows the continuous growth of vegetation and the eventual formation of peat. Water that is forced to the surface carries with it sand and silt that is added to the peat, and enhances the formation of mounds. The peat mounds provide a year-round wet area for a unique assemblage of animals, which are dependent on a continuous supply of fresh groundwater from the Gngangara Mound.

Mound springs were often historically excavated to create farm dams, or cleared and sealed with limestone to provide pasture for horses and cattle. Only three vegetated areas containing these mound springs remain, and are found in Bullsbrook and Muchea, north of Perth. In 1995 and 2001 CALM and the Commonwealth jointly purchased two of the three areas containing the mound springs; the areas are now Faull Street and Neaves Nature Reserves.

Green Corp teams have contributed significantly to the on-ground management of the mound springs in Muchea. With the help of funds obtained through WWF in 2000, a team worked for 10 days removing river gums that are a major weed on the mounds, and had the potential to dry out the springs. Several hundred saplings were cut out and the trunks poisoned. Budding club-rush, which is a major weed in very wet areas at the site, was hand-pulled. Staff from CALM's Swan Coastal District have also been working to eradicate other invasive weeds, such as blackberry (*Rubus fruticosus*) and kikuyu grass (*Pennisetum clandestinum*), by careful application of herbicide. The Ellens-Brockman Integrated Catchment Group, who have a particular interest in the springs, have been involved in information days and have sought increased involvement in their management.

Community Partnership

The management of the reserves containing the TECs discussed here and many others is the joint responsibility of all stakeholders. CALM will continue to work with them and assist volunteers wherever possible. Volunteers are to be congratulated for their tireless work and commitment to these areas. They are great examples of community support for the environment and the extremely positive work that many volunteers achieve.

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Conservation of life through death - the natural way

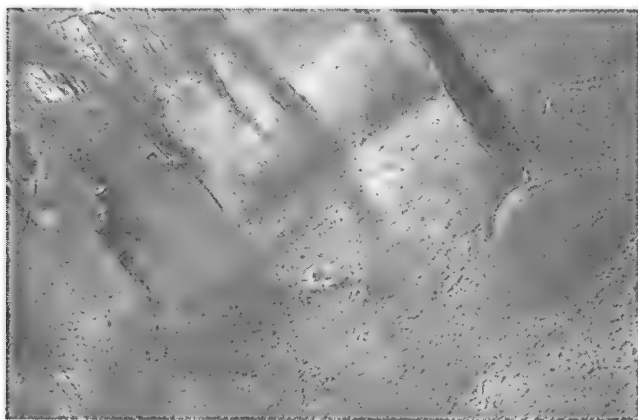
Sheryn Da-Re*, Deborah McBurnie and Melissa Taylor

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Within the noise of urban life there is a place that cradles the silence of the population - the cemetery. It is generally viewed as a sombre place consisting of sweeping lawns, manicured gardens and headstone rows. Well not any more - there's a change in the realm of the dead and our native vegetation will be reaping the benefits.

Australia's first truly 'natural' cemetery is in the initial stages of design since landscape architect Sheryn Da-Re and her team from GeoLINK in northern New South Wales completed a Feasibility Study and a Design Ideas Masterplan for Castlereagh Cemetery. Located within close proximity to the sprawling activity of Penrith and with the support of Penrith City Council, this 15.37 hectare is stamped to offer a final resting place that values and promotes the ecology of the landscape. This 'natural' approach seeks to preserve a vibrantly functioning woodland and forest environment supporting natural ecological functions as well as human interaction via cemetery and crematorium uses.

The site was reserved in 1903 as "Crown Reserve for Cemetery Purposes". An initial feasibility study identified endangered species and endangered ecological communities



The woodlands of the adjoining historic Castlereagh General Cemetery provide the ultimate 'natural' resting place for the dead. Photo: Sheryn Da-Re

species that are rare and regionally significant within Western Sydney.

The thriving bushland meant a traditional cemetery design solution was not suitable and the 'natural' cemetery idea was born. This approach was based on the United Kingdom concept of returning the dead to a world of nature – a 'dust to dust' cycle of life approach. This allows people, in death, to nourish the land and help to fund the rehabilitation of native bushland.

The final Ideas Plan sought to conserve and rehabilitate the natural landscape and provide the opportunity for educational and interpretive activities.

Sheryn's design maintains the integrity of the surrounding bushland with burial sites that integrate into the landscape. Traditional memorials such as headstones or memorial beams are not encouraged. The preference is for mourners to commemorate the deceased by planting a local indigenous tree species or shrub. This native living memorial would be offered by the cemetery management who would collect and propagate stock from seed collected on the site - subject to permits and approvals. This approach would retain the genetic integrity of the ecology.

Mowing would be discouraged with groundcovers and grasses left to grow over plots so as to visually reflect the cycle of life approach. The site would have restricted vehicle access and the introduction of authentic or artificial flowers, vases and other gifts would be prohibited.

The Ideas Plan recommends a number of maintenance strategies to protect threatened species and ecologically significant communities. A revegetation plan is also provided which describes priority areas and the use of flora species that already occur on the site.

When the final curtain closes, the natural cemetery offers the ultimate living memorial for the dead and has far reaching implications for the integration of essential human uses and the conservation of native flora and fauna.

Conservation on the front line - restoring habitat for the Leafy Greenhood (*Pterostylis cucullata*) in Belair National Park, South Australia

Karina Mercer¹ and Annie Bond²

¹Threatened Species Network, c/- Nature Conservation Society of SA ²Threatened Plant Action Group, c/- Nature Conservation Society of SA.

The Leafy Greenhood, *Pterostylis cucullata*, is a ground dwelling native orchid that occurs in South Australia, Victoria and Tasmania. The species is listed as Vulnerable

nationally (under the *Environmental Protection and Biodiversity Conservation Act 1999*) and is also listed as vulnerable within South Australia and Victoria, and as

Endangered within Tasmania. Within South Australia, the species is currently known from only four locations in the Mount Lofty Ranges east of Adelaide, and a from a disjunct fifth location in the south-east of the state.

The Leafy Greenhood in the Mount Lofty Ranges, South Australia

The Mount Lofty Ranges are a range of hills about 150km long and about 35km wide that extend from Cape Jervis in the south to the Barossa Valley in the north, and from Callington in the east to the Hills Face Zone in the west. Once found across the Mount Lofty Ranges from Tea Tree Gully to Macclesfield and Hindmarsh Valley, the Leafy Greenhood is now only known from four locations, with much suitable habitat cleared for agriculture and urban development. Construction of a shopping complex and extension of a golf course reputedly destroyed two populations. Surviving populations are now highly fragmented, occur in isolated patches of native vegetation, and are threatened by habitat degradation caused by weed invasion and disturbance. Four recent population extinctions have been attributed to weed invasion. There are estimated to be over 11,000 plants surviving in the Mount Lofty Ranges, with the largest known population in Belair National Park.

Belair National Park

Dedicated in 1891, Belair National Park, only 13 kms from the Adelaide Central Business District, was the first to be declared in South Australia. Although the area fortunately escaped subdivision and development, there have been many other pressures on its natural environment. In the early colonial days the area was reserved as a government farm where horses were agisted for the police and survey departments. Part of the area was also once a Forest Reserve where forests were thinned and timber harvested. Since the 1900's the park has been very popular with picnickers, and facilities such as tennis courts, ovals, a golf course, roads and pavilions were established. Also early in the park's history many exotic plants were deliberately established, some in large-scale plantings, which still remain today.

The park continues to be very popular with visitors, recreational facilities are still maintained and some roads and watercourses are lined with trimmed hedges and large exotic trees, the legacy of previous generations. Urban housing as well as semi-rural blocks surround Belair National Park. Much native vegetation in the park has been

severely degraded by the invasion of environmental weeds, many of which are 'garden escapes'.

Threats to the Leafy Greenhood

Threats to the population of *Pterostylis cucullata* in Belair National Park include competition and degradation of habitat through weed invasion, grazing by rabbits and possibly kangaroos, illegal collection, and disturbance during recreational and park maintenance activities.

Weed invasion has significantly modified the structure of the native vegetation. Habitat that was once open grassy woodland with a very sparse shrub layer is now almost impenetrable with Blackberry (*Rubus* sp.), Montpellier Broom (*Genista monspessulana*), Gorse (*Ulex* sp.), Boneseed (*Chrysanthemoides monilifera*), and Ivy (*Hedera helix*). Olive (*Olea europaea*) and Sweet Pittosporum (*Pittosporum undulatum*) also shade the understorey with their dense canopies. Sweet Pittosporum is native to parts of the eastern coast of Australia, but it is not an indigenous species in South Australia. Freesia, Soursob (*Oxalis pes-caprae*), and other exotic grasses and herbs are also contributing to the decline of the Leafy Greenhood habitat.

Reversing the Decline

In 1992 conservation activities for the Leafy Greenhood were initiated in Belair National Park. Population surveys were undertaken, permanent monitoring quadrats were established, and volunteers from the Threatened Plant Action Group (TPAG) began weed control for remnant populations (Davies 1995). Since then, an annual program of 2-3 half day working bees has been co-ordinated by TPAG and the Native Orchid Society of South Australia. Friends of Belair National Park and other volunteers have also been valuable participants.

We estimate that over 700 volunteer hours have contributed to the management of these sites to date.

Work began at two priority sites approximately 1.5 kilometres apart. Techniques used were based on minimum disturbance weed management as described in Robertson (1994). Woody weeds such as Boneseed, Montpellier Broom and seedlings of Sweet Pittosporum and Olive were hand-pulled where possible or treated with glyphosate using the 'cut and swab' method. A variety of other weed control methods have been trialed and refined, to meet the specific needs of the sites. These include ring barking, 'scrape and paint', 'drill and fill', spot spraying, and slashing in order to control seed set or to stimulate new growth which is more easily treated with herbicide.



Leafy Greenhood, *Pterostylis cucullata*.
Photo: Y.Steed

Since 1999, funding has been provided by the Urban Forest Biodiversity Program, the Patawalonga Catchment Board and most recently the Australian Government's Envirofund. These funds (over \$20,000 so far) have employed skilled bushcare contractors to contribute to the weed management programs. Bushcare contractors have focused on weed management in areas that are unable to be undertaken by volunteers. Through this work it has been possible to link the two original sites with a corridor of restored habitat.

Department for Environment and Heritage staff at Belair National Park have supported this work and assisted by providing in-kind support for the project. Liaison with park managers and advocacy to raise the profile of the species have helped to address threats from recreational or management activities and further development.

Davies (2004), records that since the initial survey in 1992, three new subpopulations have been discovered in Belair



Native Orchid Society of South Australia members using the 'cut and swab' method to remove Boneseed. Photo: P.Clark

National Park, while one subpopulation has become extinct. Of the three subpopulations for which weed management has been undertaken, two have increased in numbers (one increasing from 1500 plants to 2000), and one has decreased in numbers from 530 to 200 plants, and none have become extinct. These are considered to be positive results and will encourage volunteers to continue weed management actions in the future.

Other threatened species are also known to occur in the area including *Glycine latrobeana*, and the Southern Brown Bandicoot as well as several important woodland bird species. Restoring habitat for the Leafy Greenhood is also contributing to broader biodiversity conservation by restoring the structure and diversity of the South Australian Blue Gum and Manna Gum open forest community.

Acknowledgements

The authors acknowledge the use of information compiled by Rick Davies for the Draft Action Statement for the Leafy Greenhood (*Pterostylis cucullata*) (Davies 2004).

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The Corrigin grevillea (*Grevillea scapigera*): an update

Bob Dixon

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Most readers will be familiar with this landmark project (see *Danthonia* 10: 2, Sept 2001). The Corrigin grevillea (*Grevillea scapigera*) is a prostrate, woody perennial about 10 cm high (flowering scapes to 30 cm) and 1 to 2 m across, rarely to 4 m. It was first collected in 1954, and has been known from only 13 small, scattered populations restricted to a 50 km radius area around the Wheatbelt town of Corrigin in Western Australia.

The Wheatbelt region has been extensively cleared and farmed. Corrigin Shire is one of the worst affected areas, with about 95 percent of land cleared and further native vegetation lost through salinisation, weed encroachment, and grazing. Due to its rarity the only way of saving Corrigin grevillea for future generations was to translocate it back into the wild.

Translocation has been ongoing since the first trial planting began in 1993. Dr Maurizio Rossetto studied the biology of the plant for his PhD, which included an assessment of genetic diversity and propagation methods. For translocation, 10 clones were identified which represented 87% of the known genetic diversity of the species. Initial plants were grown vegetatively, mostly by tissue culture, to produce an exact replica of the parent plants. As new germinants have appeared in wild populations they are propagated and planted out to add more genetic diversity, hence the number of clones on site is increasing. This new genetic resource, as well as the other clones, has been preserved in cryostorage for future use, and as an insurance against any disaster such as disease.

The translocation was to occur on three secure sites with similar soil and vegetation types. This was a challenge in itself as few similar vegetation pockets still occur, and it was not until 2000 that planting began on the third site.

Present status

The numbers of this critically endangered species in the wild are currently down to three mature plants and two seedlings. Though a disturbance opportunist, populations in the wild are unlikely to increase significantly as most occur as single plants on badly degraded road verges.

The situation on the three translocation sites, however, is encouraging. The two earlier irrigated sites contain large numbers of plants and there have been large seed rains to the soil seed bank. The third site currently contains a few mature plants that had not flowered or seeded for two years because of drought conditions. This site has been improved by enlarging it to 0.2 ha, fencing with rabbit proof wire, fitting a reticulated irrigation system, and adding over 1000 new plants to the site. About 600 new plants were also added to the other sites to increase genetic diversity and fill in gaps. Many of these poorly represented clones were recovered from *ex situ* cryogenically or tissue culture stored germplasm. Resulting seed, harvested in December 2003, from the cryostored plants is soon to be sown and the resulting seedlings will be evaluated. Total mature plants in the three translocation sites, excluding the 1600 planted last winter, number about 634 (October 2003).

The winter of 2003 saw the first natural recruits, 10 seedlings, on one site. Germination occurred under dead *Grevillea scapigera* plants where there should be a large soil seedbank, and between rows of plants amongst cape weed (*Arctotheca calendula*). This illustrates that a dispersal agent, perhaps ants, are moving the seed, and that some seedlings are capable of germinating and surviving despite severe competition from weeds. These seedlings are not being watered as we wish to look at natural survival rates and establish if the translocations can be self-sustaining in the long term. Surprisingly most of these seedlings have survived the summer drought and should flower next spring.



A winter planting growing well on a newly expanded site.
Photo: Bob Dixon

Herbicide trials for the control of cape weed have been conducted to test efficacy and the tolerance of *Grevillea scapigera* to the herbicides. To date one herbicide has shown no deleterious effects, at high rates, when applied to mature plants of *Grevillea scapigera*. The same herbicide has been trialed over seed and seedlings in glasshouses as a pre- and post-emergent herbicide. At high rates some damage has resulted when applied directly to seedlings. No deaths have occurred and the plants are being grown on to monitor the long-term effects.

This translocation project is a team effort managed by Kings Park and Botanic Garden and the department of Conservation and Land Management with assistance from Corrigin Land Conservation District Committee, local volunteers, including the Bullaring community, and Kings Park Master Gardeners.

This project, over the years, has been funded mainly by the Department of the Environment and Heritage, and also through smaller grants from the World Wide Fund for Nature. The recent site enlargement and improvement was funded by the Western Australian Government's Environment Minister's Community Conservation Grant.

An urban conservation dilemma: The endangered ecological community of Blue Gum High Forest.

Lesley Waite, North Shore Group of the Australian Plants Society

In 1788, the high shale-clay ridgelines of Sydney's North Shore were dominated by Blue Gum High Forest (BGHF). Of an estimated original extent of about 3720 hectares, less than 2.5% remains on public land with intact understorey, or with potential for regeneration. Only 1% remains of those areas with full integrity (Benson & Howell, 1990).

The forest that built Sydney.

Only a couple of months after the First Fleet arrived in Sydney Cove, Captain Arthur Phillip passed through this 'heavily timbered country' on his first inland exploration. The deep rich soil and high rainfall (over 1100mm p.a.) supported a majestic tall forest, 30 metres or more in height,

dominated by the smooth-barked *Eucalyptus saligna* (Sydney Blue Gum) and *Eucalyptus pilularis* (Blackbutt). Almost 20 years later, George Caley reported that he had 'not seen so good forest land in the country'.

Blue Gum High Forest became the 'forest that built Sydney'. The tall straight hardwoods were logged for early Sydney's buildings, bridges and wharfs. Later clearance was for farms and orchards, and eventually for suburbs.

BGHF is listed as an Endangered Ecological Community under the NSW Threatened Species Conservation Act, 1995. It also fits the criteria for "critically endangered" under the *Commonwealth Environment Protection and Biodiversity Conservation Act 1999*, for which it was recently nominated. The entire extent of BGHF is now in the suburbs, with only a few small reserved remnants large enough to sustain and regenerate themselves and their understorey.

This forest type forms a striking contrast to the surrounding sandstone bushland of northern Sydney. Its former extent is still marked by magnificent remnant trees scattered through the shale-clay suburbs. These doomed, non-regenerating trees continue to give the north shore much of its landscape character.

Stabilising the largest remnant

The largest BGHF remnant still with its original understorey species is on Mona Vale Road, St Ives. This remnant, at 18 hectares, constitutes half of the surviving 1% of high-integrity BGHF, and retains a substantially intact and diverse understorey under a 30+ m tall canopy.

The story of this remnant shows how, at these extreme levels of reduction, even a small component of land can play a pivotal role in aiding the viability of a community. Attention is now centred on a critical one-hectare portion.

The 18ha is made up of Dalrymple Hay Nature Reserve (11ha), Browns Forest (5ha), a parcel of Sydney Water land (1ha) and the contentious hectare of privately owned land, zoned 'residential' but largely still in its original state.

The whole remnant contains some 176 species of native plants (28 of which are on the privately owned hectare and not recorded in the adjoining nature reserve), 79 native bird species, and four species of bats.

The private hectare connects the BGHF remnant to a partial corridor towards larger areas of reserved bushland. It is also incised into the remnant BGHF, and development would mean a threefold increase in edge-to-area impacts on the adjoining reserved parts of the remnant, such as an increased weed front, greater nutrient flows, and increased frequency of hazard reduction burning, all affecting the remnant core.

The single hectare is thus the key to stabilising the boundary-driven threat processes. Despite one Land and Environment Court ruling that development would be inappropriate (citing fire risk and adverse impacts on the BGHF), pressures continue for Council to approve some form of development.

Key lessons for managers of suburban remnants

Perhaps the biggest lesson of this and similar situations is that public authorities should act early and decisively to consolidate high-value remnants and corridors. This does require expenditure, but the longer it is put off, the greater the outlay is likely to be. As remnants of lower value are cleared or become more compromised, community and legislative pressure for effective management of the better patches will only increase. Meeting the public demand will often mean a buy-out of priority land parcels.

The sustained escalation of suburban real estate values means early action is cheaper. Boundary consolidation to minimise edge effects is financially and administratively effective not only for owners of reserved areas but for adjacent properties too, allowing councils, fire authorities and neighbours a stable basis for long-term planning, investment, building standards, asset protection, and vegetation management.

A coalition of concerned local groups, the *Blue Gum High Forest Group*, is working to encourage a buy-out of the private block by Ku-ring-gai Council, the State and Federal governments, and the local community, and has set up a tax-deductible donation fund. For further information please contact Lesley on (02) 9654 2146 (ah) or Neroli on (02) 9489 5794 (ah).

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Urban ecology – progress in Christchurch: the garden city

David R. Given

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Christchurch has long been regarded as one of the most English of cities outside the British Isles and has enjoyed a reputation as 'the garden city'. Horticulture is a strong force in Christchurch and the traditional 'quarter acre section' of

residential land induced many residents to plant a rich assemblage of plants. It is ironic that Christchurch is in a region of biodiversity richness yet its reputation is largely built on exotic plants. This has led to debate – sometimes

vociferous - in recent years over the place of native plants and exotic species in the city structure.

Significant long-term changes are in progress in Christchurch. For some years the Council has promoted re-planting of the city's many waterways with species (chiefly native) that will start to bring biodiversity back into the urban environment and will also familiarise people with the amenity value of many of our native species. The Styx River in the northern part of the city is a specific large-scale restoration project and includes a 'Living Laboratory' study site. This waterways initiative has involved a number of people including Ken Couling, Robert Watts and Christine Heremaia of the City Council and Colin Meurk of Landcare Research. A current issue is maintenance and the challenge of integrating stream restoration into adjacent residential and parkland areas.

The City Council is in the process of working through and deciding on a comprehensive city-wide Biodiversity Strategy. The strategy will build on a booklet on the city's biodiversity produced several years ago and draw attention to the wide range of indigenous species that still survive within the city. Species like Canterbury mudfish and the endangered duck New Zealand scaup are starting to thrive again within the city boundaries. It also draws on work done by Colin Meurk and Di Lucas who have delineated broad soil-vegetation-landform zones across Christchurch, related to the pre-European landscape.

The Isaac Centre for Nature Conservation at Lincoln University and the City Council have an Urban Ecology

Working Group that brings together council staff and researchers. The Canterbury Regional Council is also represented on this group. One of the outputs has been a rapidly expanding research agenda that can be used as the basis for collaborative research bids and prioritising issues and problems in Christchurch, especially in the light of current city expansion, both for industry and housing. This has resulted in subcontracted collaboration in a Foundation for Research Science and Technology (FRST) project led by Landcare Research that will carry out biological and landscape research in the southwest of the city over the next three years. A PhD project by Helen Greenup (recent recipient of the inaugural Zonta Branz Award) will focus on finding which New Zealand plant species are best suited to grow in built-up areas.

The Christchurch Botanic Gardens is undergoing a major review and capital investment programme over the coming five years (stimulated by its 150th anniversary being in 2013). This includes plans to develop a collaborative research programme, which will facilitate research in the urban environment. The Botanic Gardens and adjacent Hagley Park provide a marvellous natural laboratory of green space, and at over 250 hectares is reputed to be one of the largest continuous areas of city centre parkland in the world. Currently we are looking at ways that this can be used for experimental work and biodiversity trials through collaborative arrangements with research organizations.

So, the future for urban ecology looks good in Christchurch, so that in years to come alongside its image as the garden city can also be the accolade of 'ecological city'.

Update from the New Zealand Plant Conservation Network

John Sawyer

Secretary, New Zealand Plant Conservation Network, info@nzpc.org.nz, www.nzpcn.org.nz

The New Zealand Plant Conservation Network's annual conference and AGM is to be held at the Auckland Regional Botanic Gardens in Manurewa, Auckland on Saturday 7th August 2004. Workshops to be run during the day include:

- An introduction to the threatened plants of Auckland
- An introduction to New Zealand fungi
- A threatened plant translocation workshop
- A tour of the threatened plant garden at the Auckland Botanic Gardens

The New Zealand Plant Conservation Network has continued to grow at a steady pace with new members joining each week (including territorial authorities, private individuals, government agencies and botanists). Use of

the Network's website has doubled in the last six months with over 2400 visitors now accessing the site each month. Funding has been received for the next three years to improve and add further information to the website about New Zealand's threatened plant life. A series of new features have been added recently to the site including a search engine for threatened plants as well as a plant conservation bibliographic search engine. For more information see www.nzpcn.org.nz

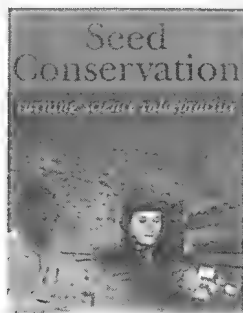
A regular electronic E-newsletter is now sent out to members each month with information about plant conservation events, news and stories. For more information about the New Zealand Plant Conservation Network email info@nzpcn.org.nz or write to P.P. Box 16-102, Wellington, New Zealand.

Book Review

Seed Conservation: turning science into practice

Edited by RD Smith, JB Dickie, SH Linington, HW Pritchard and RJ Probert

Royal Botanic Gardens, Kew, 2003 - 1,023 pages. Price US \$110.90. To order visit <http://www.kewbooks.com>



In 2001 an international workshop, hosted by the Royal Botanic Gardens, Kew, was held to review the science and technology relating to seed conservation efforts around the world. The result of this workshop is 'Seed Conservation: turning science into practice'. This book aims "to re-establish a baseline position on seed conservation science and technology, against which future progress in the subject

could be assessed". To this end this publication has been a great success. The book is broken into three sections, 'Planning and collection', 'Processing and testing' and 'Storage and utilization', that takes the reader logically through the seed conservation process.

'Planning and collection', starts with an overview of the Convention on Biological Diversity, then goes through the planning process, moving on to the issues of seed maturity and quality, finishing with examples of collection programmes from around the world.

The second section focuses on issues of seed processing

and testing. These include the general principles of seed processing, the non-destructive measurement of seed moisture, viability testing, seed germination and seed dormancy. A dichotomous key of the five dormancy types is provided in the chapter by J&C Baskin and should provide a useful tool for standardising the approach taken to classifying dormancy around the world.

The final section, 'Storage and utilisation', starts by examining the factors to consider when designing a long-term seed storage facility. This is followed by a review and survey of a range of containers (and associated seals) for their suitability for long-term storage. Leading on from the practical aspects of seed storage are a number of chapters dealing with the theory of seed longevity, finishing with a range of case studies from seed storage facilities around the world that have been putting the theory into practice.

'Seed Conservation: turning science into practice' successfully bridges the gap between science and practice and will provide a valuable reference for anyone involved with the collection, processing or storage of seed.

Andrew Crawford

Senior Technical Officer, Threatened Flora Seed Centre, Department of Conservation and Land Management, Western Australia.

Research Roundup

Cruse, L. and Maybery, D. (2004) **Personality and landholders' management of remnant bush and revegetation in the Murray Catchment.** *Australasian Journal of Environmental Management* 11(1): 21-33.

Flematti, G.R., Ghisalberti, G.L., Dixon, K.W., and Trengove, R.D. (2004) **A compound from smoke that promotes seed germination.** Published online July 8 2004; 10.1126/science.1099944 (*Science Express*: www.sciencexpress.org). Print version will appear in *Science* shortly.

Announces the discovery, of a highly potent chemical in smoke that germinates a full range of Australian and overseas species known to be smoke responsive, by a Western Australian research team from Kings Park and The University of Western Australia. The discovery has been hailed as the most significant ecological discovery in recent time and as

quoted by Dr Steve Harris "The implications of this world-class research are profound and I sense that it will inspire a paradigm shift in ecological research dealing with fire, origins of fire and fire-dependent flora, vegetation patterning, and vegetation management." More in a future issue of APC.

Hill, S.J. and French, K. (2004). **Potential impacts of fire and grazing in an endangered ecological community: plant composition and shrub and eucalypt regeneration in Cumberland Plain Woodland.** *Australian Journal of Botany* 52(1): 23-29.

Koch, J.M., Richardson, J. and Lamont, B.B. (2004). **Grazing by Kangaroos Limits the Establishment of the Grass Trees *Xanthorrhoea gracilis* and *X. preissii* in Restored Bauxite Mines in Eucalypt Forest of Southwestern Australia.** *Restoration Ecology* 12(2): 297-305.

Leeson, K.E. and Kirkpatrick, J.B. (2004). **Ecological and physiological explanations for the restriction of a Tasmanian species of *Ozothamnus* to a single population.** *Australian Journal of Botany* 52(1): 39-45.

McDougall, K.L. and Wright, G.T. (2004). **The impact of trampling on feldmark vegetation in Kosciuszko National Park, New South Wales.** *Australian Journal of Botany* 52(3): 315-320.

Murray, B.R. and Lepschi, B.J. (2004). **Are locally rare species abundant elsewhere in their geographical range?** *Austral Ecology* 29(3): 287-293.

Reiter, N., Weste, G. and Guest, D. (2004). **The risk of extinction resulting from disease caused by *Phytophthora cinnamomi* to endangered, vulnerable or rare plant species endemic to the Grampians, Western Victoria.** *Australian Journal of Botany* 52(3): 425-433.

Thomson, V.P. and Leishman, M.R. (2004). **Survival of native plants of Hawkesbury Sandstone communities with additional nutrients: effect of plant age and habitat.** *Australian Journal of Botany* 52(2): 141-147.

Tierney, D.A. (2004). **Towards an understanding of population change for the long-lived resprouting tree *Angophora inopina* (Myrtaceae).** *Australian Journal of Botany* 52(1): 31-38.

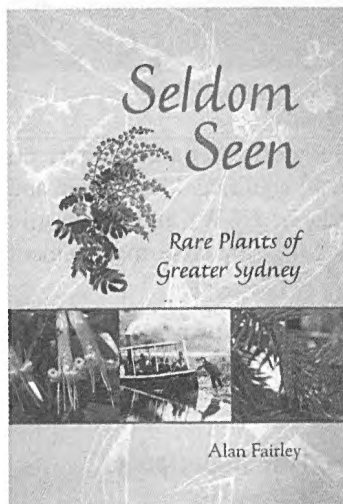
Yates, C.J. and Ladd, P.G. (2004) **Breeding system, pollination and demography in the rare granite endemic shrub *Verticordia staminosa* ssp. *staminosa* in south-west Western Australia.** *Austral Ecology* 29(2): 189-200.

Publications and Information Resources

Seldom seen : rare plants of greater Sydney.

A. Fairley. 2004. Reed New Holland

Features approximately 210 rare plants occurring within the Greater Sydney botanical area (from just west of Lithgow, north to Port Macquarie and south to Nowra). The entry for each species consists of at least one colour photograph, a botanical description and notes on its habitat and distribution. Being rare, many of these species have never before been seen in colour photographs. The history of the plant's naming and collection and other interesting



facts are also provided. Throughout the book there are a number of historical illustrations including photographs of historical field trips or famous botanists and collectors. Some notes on the collectors and botanists who have contributed to our knowledge of Sydney's rare plants are compiled in an appendix.

ISBN: 1876334991. 208 pages. \$29.95. Available from Reed New Holland Publishing 02 99756799.

Who cares about the environment in 2003? : a survey of people's environmental knowledge, attitudes and behaviours.

Department of Environment and Conservation, Sydney.

Contains the results of a study measuring environmental knowledge, views, attitudes and behaviour of people across NSW. The results of questionnaires completed in 2003 by 1421 NSW residents aged 18-70 are presented. For example, the study found that people value the environment as part of their lives, placing it third after family and friends; and would pay to help fix environmental problems or to prevent damage.

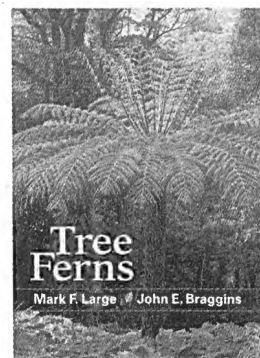
ISBN 1741370299. 84 pages. Available to download or order at www.environment.nsw.gov.au/whocares/index.htm.

Tree Ferns

M.F. Large and J.E. Braggins. 2004. CSIRO Publishing.

This book is the source of information on the living tree ferns. Tree fern habitat, distribution, evolution, conservation and ethnobotany are discussed. The main body of the book provides descriptions and details of all living tree ferns. The cultivation and propagation of tree ferns is also discussed in detail.

ISBN 0643090762. 360 pages. \$59.95. Available from www.publish.csiro.au.



Electronic Addresses

PlantNet

PlantNET, developed by the Botanic Gardens Trust Sydney, delivers descriptions, identification keys and images of the plants of NSW, based on the printed 'Flora of NSW'. The site also hosts other national and international botanical sites and provides links to other sites that provide botanical, biodiversity and natural resources information.

Go to: <http://plantnet.rbgsyd.nsw.gov.au/>

Biodiversity Toolbox

The *Biodiversity Toolbox* is designed to provide local governments with the tools, resources and contacts to integrate biodiversity conservation into all aspects of council operations. The site will also be useful to anyone involved in the planning and management of biodiversity conservation. Information provided includes: examples of biodiversity conservation strategies developed by councils; links to strategic planning guides, environmental indicators, mapping databases, and flora and fauna survey guidelines; and links to Commonwealth, State and Territory policies and legislation.

Go to: <http://www.deh.gov.au/biodiversity/toolbox/index.html>

SA Urban Forests Biodiversity Program

The South Australian Urban Forest Biodiversity Program (UFBP) has the vision of conserving the biodiversity of greater Adelaide. Grazing, agriculture, horticulture, residential development and industry have progressively all but replaced the unique flora and fauna of the Adelaide Plains to the point where less than 2% of the original habitat remains intact.

To find out more about the UFBG go to: <http://www.urbanforest.on.net>

Exchange: National Vegetation Knowledge Service

Exchange, developed by Greening Australia, is a new knowledge delivery service that aims to bridge the gap between scientific research and the knowledge and information needs of users. By linking practitioners to current research and relevant researchers, *Exchange* provides the connection needed to deliver answers to regional vegetation management questions.

Access via Greening Australia's homepage by clicking on the Exchange logo (<http://www.greeningaustralia.org.au>).

Conferences and Workshops

14th Australian Weeds Conference

6-10th September 2004, Wagga Wagga, NSW

The theme of the 14th Australian Weeds Conference is 'Weed management: balancing people, planet, profit'. This theme emphasises the difficulties associated with weed management from the production and environmental issues through to the social and economic aspects. As the impact of weeds has an effect on such a range of environments and industries, the conference attracts a diverse range of people. To cater for the diversity of weed information, the program consists of a wide range of oral presentations and posters.

For further information, visit: <http://www.csu.edu.au/special/weedsconference/index.html>

Innovations, Obligations and Incentives Wetland Forum

Tuesday 21st September 2004, The Wetlands Centre, Newcastle, NSW

The Wetlands Centre Australia is launching the first national forum in an annual series on innovations in wetland management. The forum will cover: cutting edge approaches

to managing activities in wetland catchments; an interpretation and update on all significant legislation and reforms affecting wetlands in NSW; and economic implications and incentives for sustainable management approaches.

For further information visit <http://www.wetlands.org.au/forum.htm> or contact Kylie Yeend, ph: 02 49516466, email ramsar@wetlands.org.au.

Workshop on the Translocation of Threatened Plants

24th September, Bendigo, Victoria

Aimed at anyone involved in the planning, approval or implementation of translocation projects for threatened flora. For details of the workshop content see the flyer provided with this bulletin or for more information contact the ANPC.

National Office (details on inside front cover).

Registrations close 10th September 2004.

ANPC members: \$85, non-members: \$115.

Royal Botanic Gardens Victoria



RBG00013042

Urban grasslands, their management and restoration

5 October 2004, Melton, Victoria

A seminar and short tour of urban grasslands presented by the Weed Society of Victoria Inc. in conjunction with the Melton Shire Council.

Further information can be obtained from Weed Society of Victoria. Phone/Fax: 03 9576 2949. Email: secwssv@surf.net.au

Sydney's Hands-on Environmental Forum: Inspirations, Motivations and Celebrations

5 & 6 November 2004, Sydney University, NSW

Will celebrate on-ground environmental achievement and community action in Sydney through case studies, presentations by experts and interactive workshops. It will inspire and motivate volunteers and the wider community by highlighting successful volunteer bushcare, urban biodiversity, stormwater, advocacy and community engagement projects and activities. The forum is an initiative of the Sydney Metropolitan Catchment Management Authority Local Establishment Team.

Cost: Community \$25 each day / \$45 for both days

Professional \$80 each day / \$150 for both days

Registration for the Forum and a full program will be available in August, and notified at that time on the Sydney Nature Carers email group. To join this group, send an email to SnaC-subscribe@yahoogroups.com (membership is free).

For further information contact Community Support Officer, Leanne Cusiter on 02 9895 5965 or email leanne.cusiter@dipnr.nsw.gov.au

Plant conservation courses in South-East Queensland

Are you interested in the conservation and rehabilitation of South-East Queensland's plant and ecosystem diversity?

Two courses on conservation and rehabilitation techniques will be available in late 2004, specifically tailored for the region. Course topics are being developed in consultation with stakeholders to meet regional needs and priorities.

For further information:

- Check the Australian Network for Plant Conservation website <http://www.anbg.gov.au/anpc/>. Course dates, venues, registration forms and programs will be posted there as soon as they are finalised.
- Ring Sally Stephens in the ANPC office on 02-6250 9523.

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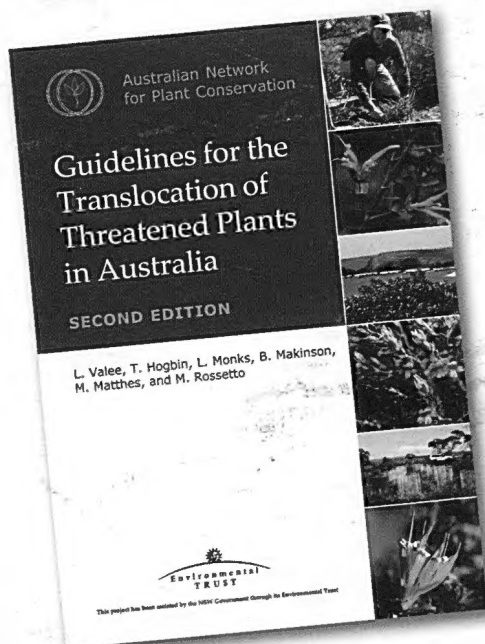
TransGrid



Department of Sustainability and Environment



NORTH CENTRAL Catchment Management Authority



NEW Guidelines for the Translocation of Threatened Plants (Second edition)

Only \$22 + postage & handling

See inside for Order form,
or download form from

<http://www.anbg.gov.au/anpc/books.html>

Due to the success of the NSW workshops
Australian Network for Plant Conservation
will be holding its workshop on

THE TRANSLOCATION OF THREATENED PLANTS

at the Department of Sustainability and Environment, Bendigo, Victoria

Friday 24th September 2004

ANPC members \$85

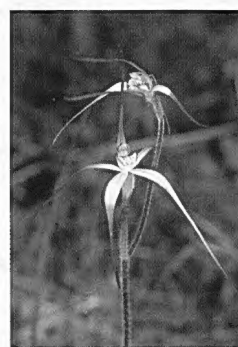
Non-members \$115



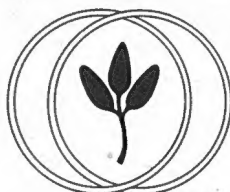
Department of
Sustainability
and Environment



NORTH CENTRAL
Catchment Management Authority



Registrations open now - registration form and additional information inside



Australasian Plant Conservation

BULLETIN OF THE AUSTRALIAN NETWORK FOR PLANT CONSERVATION

For further information contact:
Australian Network for Plant Conservation
GPO Box 1777
Canberra ACT 2601, Australia

Ph: + 61 2 6250 9509
Fax: + 61 2 6250 9528
Email: anpc@deh.gov.au
Website: <http://www.anbg.gov.au/anpc>